APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/237,128	01/25/1999	FRANK KASTENHOLZ	AGM-002	9585

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EXAMINER
HO, DUC CHI

ART UNIT	PAPER NUMBER
2665	

DATE MAILED: 06/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No. ●	Applicant(s)
Office Action Summary	09/237,128	KASTENHOLZ, FRANK
	Examiner	Art Unit	
	Duc C Ho	2665	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>25 January 1999</u> .

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-31</u> is/are pending in the application.

   4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1-31</u> is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

   Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

   If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   a)☐ All b)☐ Some * c)☐ None of:

   1.☐ Certified copies of the priority documents have been received.

   2.☐ Certified copies of the priority documents have been received in Application No. _____ .

   3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

   * See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

   a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>3&5</u> .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 112

1.   Claims 12-14 are rejected under 35 U.S.C. 112, second paragraph, as being

indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention.

       Regarding claim 12, line 8, it is unclear what is intended to be the claim limitation

by reciting " wherein fewer locations in the forwarding lookup are located and accessed

than bits in the associated destination address ".

Claim Rejections - 35 USC § 102

2.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102(e) that form

the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in
> public use or on sale in this country, more than one year prior to the date of application for patent in
> the United States.

3.   Claims 1-5,15-18, and 24-28 are rejected under 35 U.S.C. 102(b) as being

anticipated by " Memory organization scheme for the Implementation of Routing Tables

in High Performance IP Routers, IBM Technical Disclosure Bulletin, Vol. 36(2), pp. 151-

153; 1993 - **IDS, in record** ", hereinafter referred to as IBM.

Regarding claim 1, IBM discloses memory organization scheme in IP routers in which the identification of the next hop, its IP address and the corresponding output port is done by table lookup.

Providing header data for a destination of a network layer packet (In a network using the Internet Protocol (a layer three network protocol), each IP packet is a data packet containing header information and a payload. It is possible to send an IP packet called datagram from any source node to any destination node on the Internet. Such datagram, carries, in specific fields, the IP addresses of both the source and destination nodes, page 152, third paragraph.);

using multiple bits from the header data as an index to locate a selected one of the storage locations that provides information regarding how the device should forward the network layer packet (IP networks are partitioned into smaller subnetworks in a hierarchical way and are interconnected by routers. Each router has lookup tables (storage locations) containing the IP addresses of the Next Hop Router(NHR), and may have several ports, each of which is connected to a different subnetwork. Every node or subnetwork has a unique 32-bit address, called the IP address (multiple bits). This helps facilitate the network administration by allocating IP address spaces without risking any address duplication (using multiple bits from the header data as an index); *and*

employing the information provided by the selected storage location to forward the network layer packet toward the destination (If the destination does not reside on the same physical subnetwork as the source, the datagram has to be sent to a next hop router that will gradually forward the datagram on step further towards the destination, page 152, third paragraph).

Regarding claims 2, 16, and 25, each router inherently contains an instruction regarding how an IP packet containing its destination address should be forwarded , page 152, the fifth paragraph.

Regarding claims 3, and 17-18, an IP address is composed of three fields: the type, the network identifier (provided with addresses for both source and destination), and the host identifier (provided with addresses for both source and destination). Large networks are given a long host identifier (24 bits or 3 bytes), page 151, second paragraph.

Regarding claims 4, and 27, each router inherently contains some sort of extracting mechanism to extract address information from an IP packet.

Regarding claims 5, and 28, the packet is an IP packet.

Regarding claims 15, and 24, these claims have similar limitations as claim 1. Therefore, they are rejected as anticipated by IBM for the same reasons set forth in the rejection of claim 1.

Regarding claim 26, an IP address has a unique 32–bit address, which can be partitioned into 4 bytes, and used as the index.

4.   Claims 6–14, and 29-31 are rejected under 35 U.S.C. 102(b) as being anticipated by " WALDVOGEL, M. et al. Scalable High speed IP Routing Lookups. ACM SIGCOMM'97 Conference: Applications, Technologies, Architectures, and Protocols for Computer Communication, 14-18 September 1997, Cannes, France. Computer Communication Review (1997) Vol. 27, No. 4, pages 25-38, **IDS – in record** ", hereinafter referred to Waldvogel.

Regarding claims 6, and 29, Waldvogel discloses an algorithm for best matching prefix using binary search on hash tables organized by prefixed lengths.

providing a first forwarding lookup and a second forwarding lookup and a second forwarding lookup (the major step in packet forwarding is to lookup the destination address of an incoming packet in the routing database . A forwarding database may have the prefixes P1 = 0101 (first forwarding lookup), P2 = 01011101 (second forwarding lookup), page 25, right-hand column);

using a prefix of multiple bits from the destination address of the IP packet as an index to locate a first entry in the first forwarding lookup (it is well known that each IP packet is a data packet containing header information and a payload, and it is possible to send an IP packet from any source node to any destination node on the Internet by examining its destination address expressed in multiple bits in the header information. When an IP router receives a packet, it must compute which of the prefixes in its database has the longest match (a first entry in the first forwarding lookup) when compared to the destination address in the packet.);

where the first entry in the first forwarding lookup provides direction to the second forwarding lookup, using a next sequential set of bits following the prefix in the destination address as an index to locate a second entry in the second forwarding lookup (Waldvogel in page 27- 3.1 Linear of Hash Tables . The idea is to look for all prefixes of a certain length L using hashing and use multiple hashes to find the best matching prefix-BMP, starting with the largest value of L (first entry) and working backward (to locate a second entry) , *said second entry having contents ; and employing the contents of the second entry in forwarding the IP packet toward the destination address* (The packet is then forwarded to the output link associated with that second entry).

Regarding claims 7, and 30, an inherent algorithm in the router examines the prefix of the second entry and forwards the IP packet toward the destination based on the prefix.

Regarding claims 8, and 31, Waldvogel discloses indexing one position less than position of the first entry (instruction)to get to the second entry, page 27, figure 1- second paragraph.

Regarding claims 9-10, Waldvogel discloses indexing one position less than position of the first entry to get to the second entry, and continuing the search in similar way to the third entry for forwarding the IP packet, page 27, figure 1- second paragraph.

Regarding claim 11, see Waldvogel at page 33 - 4.4, the search functions are very simple, therefore, inherently implemented in ASIC.

Regarding claim 12, Waldvogel discloses an algorithm for best matching prefix using binary search on hash tables organized by prefixed lengths.

providing a forwarding lookup with locations in the memory, wherein the locations are indexed by multiple bits (the major step in packet forwarding is to lookup the destination address of an incoming packet in the IP router's database (memory) consisting of a number of address prefixes. A forwarding database may have the prefixes P1 = 0101 (indexed by multiple bits), page 25, right-hand column.)

for each data packet to be forwarded, employing bits in the destination address to locate and access at least one location in the forwarding lookup to forward the data packet, wherein fewer locations in the forwarding lookup are located and accessed than bits in the associated destination address (a forwarding table may have the prefixes P2= 0101101 and p1= 0101. When an IP router receives a packet, it must compute which of the prefixes in its database has the longest match when compared to the

destination address in the packet. The packet is then forwarded to the output link associated with that prefix.).

Regarding claim 13, the packet is an IP packet.

Regarding claim 14, Waldvogel discloses the third prefix in a forwarding database, P3= 010110101101, page 25, right-hand column.

5.   Claims 19-23 are rejected under 35 U.S.C. 102(b) as being anticipated by Degermark, M et al.(Small Forwarding Tables for Fast Routing Lookups. ACM SIGCOMM'97 Conference: Application, Technologies, Architectures, and Protocols for Computer Communication, 14-18 September 1997, Cannes, France. Computer Communication Review (1997) Vol. 27, No. 4, pages 3-14 – **IDS, in record**), hereinafter referred to as Degermark.

Regarding claim 19, referring to page 3, right-hand column, Degermark discloses IP routers do a routing lookup in a routing table to determine whether IP datagrams are to be forwarded.

multiple lookup structures (forwarding tables- page 3, right-hand column) *for assisting in the forwarding of the IP packets* (to determine whether IP datagrams are to be forwarded);

a processor(figure 1 - network processor and forwarding engine to determine which outgoing interface the packet should be sent to, page 4, left-hand column) *for executing the instructions in the entries of the lookup structures to forward the IP packets.*

Regarding claim 20, in Degermark the Internet routing tables are small enough to fit in a very compact form, such as the secondary cache of Pentium Pro processors, page 4, left-hand column.

Regarding claim 21, referring to page 3, right-hand column, Degermark discloses IP routers do a routing lookup in a routing table to determine whether IP datagrams are to be forwarded.

a first lookup array containing entries indexed by leading bits of destination address for IP packets, each entry containing an instruction to assist in forwarding an IP packet towards a destination (an entry in a routing table is conceptually an arbitrary length prefix with associated next-hop information, page 3, right-hand column, third paragraph. Referring to figure 6, page 6, left-hand column, the fourth paragraph, each entry of IP addresses has a length that is a power of 2, wherein the entry of the level 1 indexes with 16 bits (first lookup array) inherently contains reference for forwarding an IP packet towards its destination);

a second lookup array containing entries indexed by a successive of bits that follow the leading bits in the destination address for IP packets, each entry containing an instruction to assist in forwarding an IP packet towards a destination (figure 6, the level 2 (second lookup array)shows a prefix that has a successive of 8 bits more than that of the level 1, and inherently contains reference for forwarding an IP packet towards its destination);

a third lookup array containing entries indexed by a set of trailing bits that follow the successive set of bits in the destination addresses for IP packets, each entry containing an instruction to assist in forwarding an IP packet (figure 6, the level 3 (third lookup array)shows a prefix that has a successive of additional bits more than that of the level 2, and inherently contains reference for forwarding an IP packet towards its destination); *and*

a forwarding engine for forwarding IP packets to destination, wherein for each IP packet being forwarded, said forwarding engine accesses at least one entry in the

lookup arrays indexed by a destination address for the IP packet being forwarded and

executing the instruction contained in the entry that is accessed (referring to figure 1

which describes a router design with forwarding engines, in which the forwarding

engines processes the packet headers in according to the prefix matching towards the

destination, page 4, right-hand column, second paragraph).

Regarding claims 22-23, figure 1 of Degermark shows input ports and interface

structure, wherein the interface structure inherently contains reference for forwarding

the packet to destination, page 4, right-hand column, second paragraph.

Conclusion

6.   The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure. Hjalmtysson (US 6,392,996); and Rosen (US 6,337,861) are

cited to show a network packet forwarding lookup with a reduced number of memory

accesses, which is considered pertinent to the claimed invention.

7.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Duc Ho whose telephone number is (703) 305-1332.

The examiner can normally be reached on Monday through Friday from 7:00 am to 3:30

pm.

If attempt to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Huy Vu, can be reached on (703) 308-6602.

Any inquiry of a general nature or relating to the status of this application or

proceeding should be directed to the Group receptionist whose telephone number is

(703) 305-4700

8.   Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal

Drive,

Arlington. VA, Sixth Floor (Receptionist).

Patent Examiner

Duc Ho

6-2-02

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